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Please let me know if you have any questions. Thanks!

Regards,

Allison Ginn  
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# Grand Staircase-Escalante National Monument

Economic Values and Economic Contributions

*DRAFT*



Grand Staircase  
Escalante National  
Monument

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## Introduction

The purpose of this paper is to provide information on the economic values and economic contributions of the activities and resources associated with Grand Staircase-Escalante National Monument (GSENM) as well as to provide a brief economic profile of Kane and Garfield counties.

## Background information

Grand Staircase-Escalante National Monument, which encompasses 1,866,331 acres in Kane and Garfield counties in Utah, was established in 1996 by President Clinton to protect an array of historic, biological, geological, paleontological, and archaeological objects. It was the first national monument under Bureau of Land Management (BLM) multiple use management. Since designation, there have been two congressional boundary adjustments as well as an exchange of all of the State of Utah School and Institutional Trust Lands Administration (SITLA) lands within the monument boundaries. In May 1998, Secretary of the Interior Bruce Babbitt and Utah Governor Michael Leavitt negotiated a land exchange to transfer all State school trust lands within the Monument to the Federal government, as well as the trust lands in the National Forests, National Parks and Indian Reservations in Utah. On October 31, 1998 President Clinton signed the Utah Schools and Lands Exchange Act (Public Law 105-335) which legislated this exchange. The federal government received all State inholdings in GSENM (176,699 acres) while the State received \$50 million in cash plus \$13 million in unleased coal and approximately 139,000 acres, including mineral resources. The federal government received additional State holdings within other NPS and US Forest Service units as part of the same exchange. On October 31, 1998, President Clinton also signed Public Law 105-355. Section 201 of this law adjusted the boundary of the Monument by including certain lands (a one-mile wide strip north of Church Wells and Big Water) and excluding certain other lands around the communities of Henrieville, Cannonville, Tropic, and Boulder. This law resulted in the addition of approximately 5,500 acres to the Monument. In 2009, H.R. 377, the Omnibus Public Land Management Act (Public Law 111-11), directed a boundary change and purchase for the Turnabout Ranch, resulting in the removal of approximately 25 acres from GSENM.

## Public Outreach

GSENM was designated in 1996 without public engagement. However, the area in southern Utah had long been considered, discussed and evaluated for the possibility of providing greater recognition of, and legal protection for, its resources. In 1936, the National Park Service (NPS) considered making a recommendation to President Roosevelt to designate a 6,968 square mile "Escalante National Monument" (which also extended to portions of Bears Ears National Monument). A second NPS proposal proposed a 2,450 square mile National Monument. In the late 1970s, under the authority of Section 603 of the Federal Land Policy and Management Act of 1976 (FLPMA), the BLM evaluated the area for its wilderness characteristics. The Section 603 process ultimately led to the establishment of more than a dozen Wilderness Study Areas (WSAs), totaling about 900,000 acres, in the area that is now GSENM.

### *Grand Staircase-Escalante National Monument, Utah*

**Location:** Kane County, Garfield County, UT  
**Managing agencies:** BLM  
**Adjacent cities/counties/reservations:** Dixie National Forest, Capitol Reef National Park, Glen Canyon National Recreation Area, Bryce Canyon National Park, other BLM administered lands, and Kodachrome Basin State Park  
**Resource Areas:**  
☒ Recreation ☒ Energy ☒ Minerals  
☒ Grazing ☐ Timber ☒ Scientific  
☒ Discovery ☒ Tribal Cultural

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GSENM's Monument Management Plan included substantial outreach, public scoping and comment periods according to land use planning regulations and policies. Over 6,800 individual letters were received during the public scoping period. During the planning process, the planning team conducted 30 public workshops, both to elicit initial input during the scoping process and to hear comments on the Draft Management Plan after its release. The team held dozens of meetings with American Indian tribes, local, State, and Federal government agencies, and private organizations to discuss planning issues of concern to each party. Similar public outreach efforts are underway for the Livestock Grazing Monument Management Plan Amendment and Environmental Impact Statement.

#### **Local Economy and Economic Impacts**

Combined, Kane and Garfield counties make up less than half a percent of Utah's population. Current unemployment rates are similar to the state average in Kane County, but higher in Garfield County. Median household income is similar in the two counties but lower than at the State level (Table 1). The accommodation and food services industry is the largest by employment in both Kane and Garfield counties (see Figure 1).

**Table 1. Economic Profile for Kane and Garfield Counties**

Measure	Kane County	Garfield County	Utah
Population, 2015	7,131	5,009	2,995,919
Unemployment rate, March 2017 <sup>a</sup>	3.3%	7.6%	3.1%
Median Household Income (2015) <sup>b</sup>	\$47,530	\$45,509	\$62,961

<sup>a</sup> <http://www.jobs.utah.gov/wi/pubs/une/season.html>

<sup>b</sup> <https://jobs.utah.gov/wi/pubs/wni/income/index.html>

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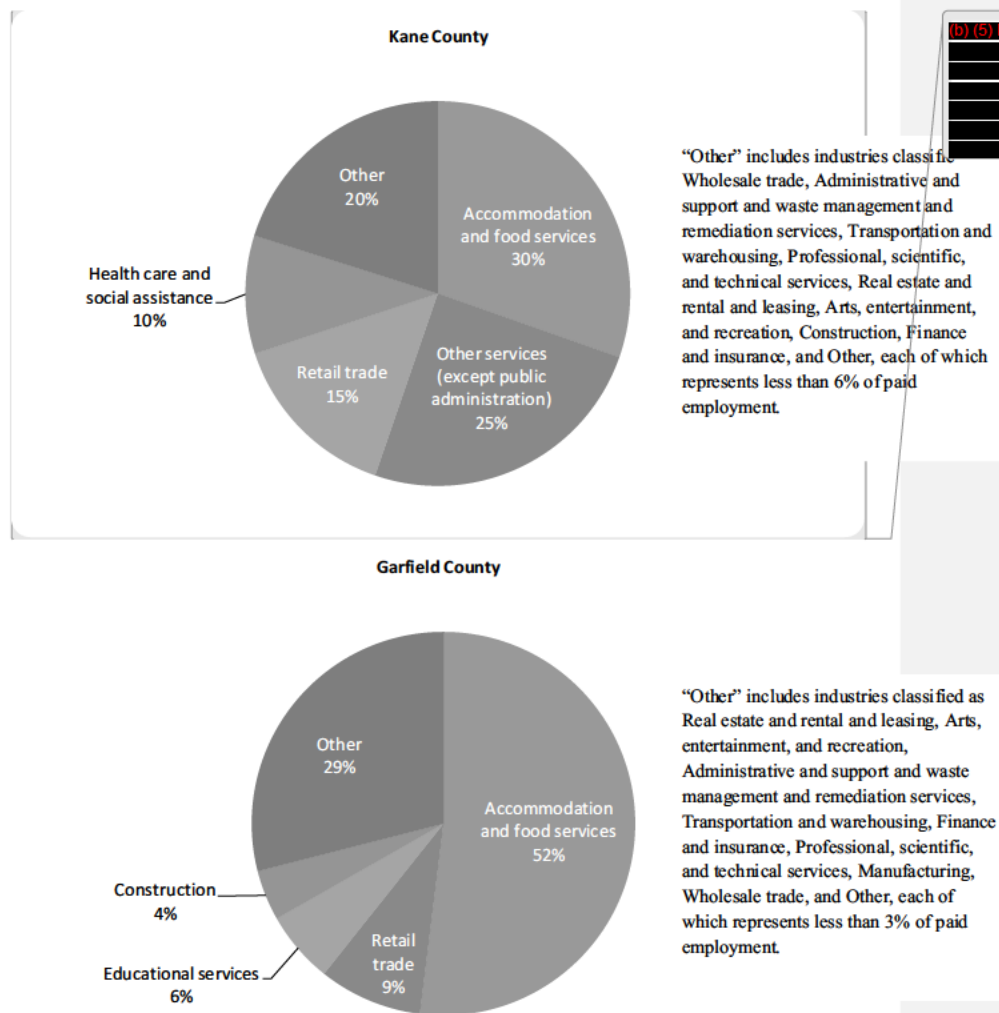


Figure 1. Percent employment by sector in Kane and Garfield Counties, 2015

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Information is provided below on two different types of economic information: “economic contributions,” and “economic values.” Both types of information are informative in decision-making. Economic contributions track expenditures as they cycle through the local and regional economy, supporting employment and economic output (see Table 2). Economic values, on the other hand, represent the net value, above any expenditures, that individuals place on goods and services (see Table 3). These values are particularly relevant in situations where market prices may not be fully reflective of the values individuals place on some goods and services.

#### Definitions

**Value Added:** A measure of economic contributions; calculated as the difference between total output (sales) and the cost of any intermediate inputs.

**Economic Value:** The estimated net value, above any expenditures, that individuals place on goods and services; these are particularly relevant in situations where market prices may not be fully reflective of the values individuals place on some goods and services.

**Employment:** The total number of jobs supported by activities.

#### Activities and Resources Associated with Grand Staircase-Escalante National Monument

Information on the activities taking place on GSENM are provided below.

- **Recreation:** Grand Staircase-Escalante National Monument provides a large variety of multiple-use recreation opportunities including traditional hiking and camping, hunting, fishing, horseback riding, mountain biking, as well as motorized activities for off-highway vehicles. Visitation has increased since designation, rising from an estimated

Table 2. GSENM Estimated Economic Contributions, 2016

Activities	Value added (net addition to GDP), \$ millions	Employment supported (number of jobs)
Recreation	50.78	1,024
Oil		
Gas		
Grazing	Grazing value-added is not available	184

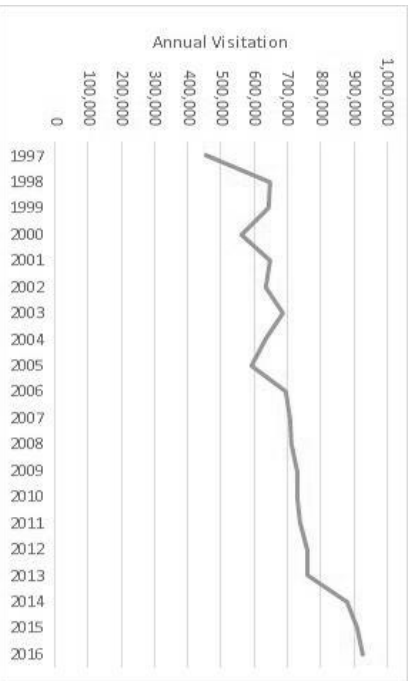
456,369 visits in 1997 to 926,236 visits in 2016 (Figure 2). BLM also issues commercial Special Recreation Permits (SRPs) for GSENM. SRPs are authorizations that allow specified recreation use of the public lands and related waters. At GSENM commercial SRPs cover a wide range of activities including general guide/hiking service, hunting & fishing guides, ATV/vehicle experiences, educational events (geology classes, etc.), horseback riding, and bicycling. The number of permits issued has increased from 35 in 1999 to 115 in 2017.<sup>1</sup>

Recreation activities provide the opportunity for economic activity to be generated from tourism for an indefinite period of time. Recreational visitors spend money at local businesses, and that spending can lead to economic contributions that affect regional and state economy. The economic contributions occur annually, and in cases where visitation increases over time, recreation generates additional activity each year. The net economic contributions associated with recreation in 2016 are estimated to be about \$51 million in value added and 1,024 jobs (Table 2).<sup>2</sup>

<sup>1</sup> BLM data.

<sup>2</sup> BLM data.

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**Figure 2. Annual Visitation to Grand Staircase-Escalante National Monument**

- **Energy:** In general, the scope, magnitude, and timing of energy and minerals activities are closely related to supply and demand conditions in world markets and the market prices of mineral commodities. Since designation, there has been some oil and gas production, but no coal production or exploration
  - **Coal.**

Exploration and Production in GSENM:

- No coal lands have been explored nor coal produced within the GSENM since designation. Existing coal leases were voluntarily exchanged for Federal payments totaling \$19.5 million (not adjusted for inflation) in Dec 1999/Jan 2000. As many as 23 companies acquired coal leases in the 1960s
- 64 coal leases (~168,000 acres) were committed and a plan was submitted for Andalex Resources' Smoky Hollow Mine prior to designation. At the time of designation, the Warm Springs Smoky Hollow DEIS was in progress to analyze the proposed mine. The plan proposed mining on 23,799 acres of the area leased in GSENM. In the mid-1990's, an EIS was initiated. In December 1999, the Andalex coal leases were voluntarily sold to the U.S. Government using Land and Water Conservation Fund funding for \$14 million.<sup>3</sup>

Coal Resources in GSENM:

- Most of the coal resources in the Monument are within the Kaiparowits Plateau Coal Field, which contains one of the largest undeveloped coal resources in the United States. An estimated 62.3 billion tons of original coal resources (coal beds > 1 foot thick) are contained in the Kaiparowits coal field, with an estimated 44.2 billion tons within the Monument.<sup>4</sup> In 1997, the Utah Geological Survey indicated that around 11.36 billion tons of the coal in the Kaiparowits Plateau

<sup>3</sup> BLM data

<sup>4</sup> 1996-1997 BLM Kaiparowits Coal Report

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coal filed are estimated recoverable.<sup>5</sup> It is possible that advances in underground coal mining techniques would result in additional coal being considered minable compared to estimates from the 1990s. In addition to the Kaiparowits Plateau Coal Field, the Monument contains some coal resources in the eastern portion of the Alton - Kanab Coal Field, which are generally of lower quality than the coal in the Kaiparowits Plateau.

- The Kaiparowits Plateau coal resources in the GSENM are estimated to make up 59% of the potentially recoverable coal in Utah, as of 2015.<sup>6</sup>

Utah Coal Market:

- In 2015, the vast majority of coal consumed in Utah (96%) was used at electric power plants. The remaining coal (3.9%) was consumed by the industrial sector at cement/lime plants and Kennecott Utah Copper's power plant (182 MW capacity), which provides electricity for copper smelting.<sup>7</sup>
- The majority of Utah coal, 80% in 2015, was used in state, while 17% was shipped out of state (up to 60% of Utah coal was shipped to others states in the early 2000s), and 3% was shipped to other countries. Domestic exports have significantly decreased in recent years as several electric plants and industrial users in California and Nevada have switched to natural gas.<sup>8</sup> California, which historically was Utah's largest coal customer, is in the process of eliminating coal use. Nevada was the next largest domestic consumer of Utah's coal, but Nevada also has decided to phase out coal use in electricity generation.<sup>9</sup>
- Utah's electricity portfolio is dominated by coal-fired power plants. However, several natural gas plants have been built in the past 15 years, decreasing Utah's reliance on coal generation. There are currently five coal-fired power plants in Utah. All of these plants are in the central part of the state.<sup>10</sup>
- About half of the coal burned in-state is delivered by truck to power plants and industrial users, and the other half is delivered by rail.<sup>11</sup> Transportation costs can contribute a large share of the costs associated with using coal as an energy resource, and can be a factor in determining the extent to which a given coal resource is economic to develop.

○ **Oil & Gas.**

- As of 1997, 47 wildcat wells had been drilled within the monument (24 in Garfield County and 23 in Kane County). Oil production is concentrated in the Upper Valley (UV) field; 5 of the 22 wells in the UV field lie within the National Monument. In addition to the producing wells, there are also two water injection

<sup>5</sup> Utah Geological Survey. 1997. A Preliminary Assessment of Energy and Mineral Resources within the Grand Staircase-Escalante National Monument. Circular 93.

<sup>6</sup> Vanden Berg, Michael D. 2016. Utah's Energy Landscape. Circular 121, Utah Geological Survey.

<sup>7</sup> Vanden Berg, Michael D. 2016. Utah's Energy Landscape. Circular 121, Utah Geological Survey.

<sup>8</sup> Vanden Berg, Michael D. 2016. Utah's Energy Landscape. Circular 121, Utah Geological Survey.

<sup>9</sup> U.S. Energy Information Administration. 2016. Utah State Energy Profile.

<sup>10</sup> Vanden Berg, Michael D. 2016. Utah's Energy Landscape. Circular 121, Utah Geological Survey.

<sup>11</sup> U.S. Energy Information Administration. 2016. Utah State Energy Profile.



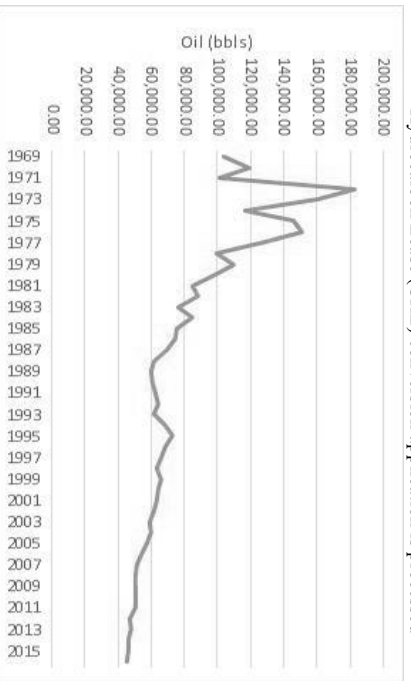
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wells in the monument. There are no oil and gas pipelines in the region, all of the

oil is trucked 300 miles to refineries in Salt Lake City.<sup>12</sup>

- The Upper Valley Oil Field was in production prior to designation; no other oil and gas production existed in Kane and Garfield Counties. From 1992 until 1996, 336,313 barrels of oil were produced in the GSENM. No natural gas was produced during that time.<sup>13</sup>

- Four wells within the GSENM are currently producing oil and a small amount of gas. The UV was approved in 1962 and production from the wells peaked in 1972 at 183,133 barrels. In the last 20 years (1997-2016) production has slowly declined from about 65,828 barrels of oil and no gas annually to 45,538 barrels of oil and 2,357 thousand cubic feet (mcf) of gas (Figures 3 and 4).<sup>14</sup> There is no other oil and gas production in GSENM, or Kane and Garfield Counties.
- 34 oil and gas leases (45,894 acres) are in suspension while a Combined Hydrocarbon Lease (CHL) conversion application is processed.<sup>15</sup>



**Figure 3. Oil Production on Grand Staircase-Escalante National Monument**

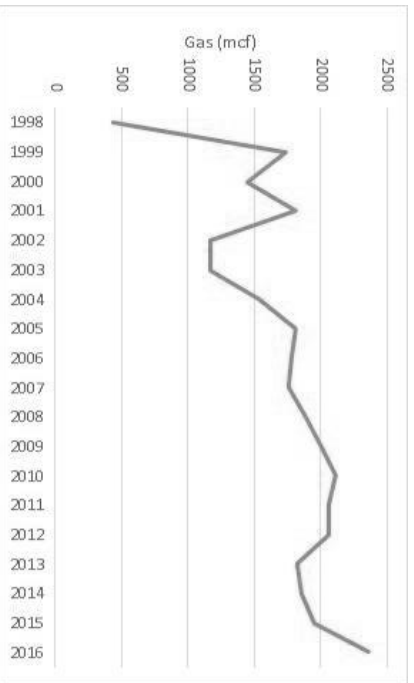
<sup>12</sup> Utah Geological Survey, 1997. A Preliminary Assessment of Energy and Mineral Resources within the Grand Staircase-Escalante National Monument. Circular 93.

<sup>13</sup> BLM data.

<sup>14</sup> BLM data.

<sup>15</sup> BLM data.

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**Figure 4. Gas Production on Grand Staircase-Escalante National Monument**

- **Non-Energy Minerals:** Five small mining operations are permitted within the Monument. Four are active quarries for alabaster, and the fifth is a suspended operation for petrified wood.<sup>16</sup> These claimants failed to pay the required annual filings and therefore, the claims were terminated. The BLM's decision to close the claims was upheld by Interior Board for Land Appeals in March 2008. Since that time, there have been no mining law operations within the monument. Valid existing permits, including those in Title 23 (3 Federal Highway Rights of Way), continue to be recognized until permit expiration. Significant quantities of gravel and riprap from existing pits continue to be provided for Federal Highways projects, primarily to Utah Department of Transportation.<sup>17</sup>

- **Grazing:** Grazing is allowed within Grand Staircase-Escalante National Monument. When the Monument was designated, there were 106,645 total Animal Unit Months (AUMs), with 77,400 Permitted AUMs.<sup>18</sup> Today, there are 106,202 total AUMs and 76,957 permitted AUMs. Total AUMs is the sum of permitted AUMs plus suspended AUMs.<sup>19</sup> The number of permitted AUMs represents the most AUMs that may be used under ideal conditions. No reductions have occurred as a result of Monument designation, though small reductions within limited areas have taken place under normal BLM procedures to protect riparian resources and to address other issues. Grazing use levels vary from year to year depending on factors such as drought. Total AUMs billed were 41,597 in 2016, with an average of 44,164 AUMs billed annually since 1996. Figure 5

<sup>16</sup> Utah Geological Survey. 1997. A Preliminary Assessment of Energy and Mineral Resources within the Grand Staircase-Escalante National Monument. Circular 93.

<sup>17</sup> BLM data.

<sup>18</sup> BLM measures an AUM as the amount of forage needed to sustain one cow and her calf, one domestic horse, or 5 sheep or goats for one month. <https://www.blm.gov/programs/natural-resources/rangelands-and-grazing/livestock-grazing/fees-and-distribution>

<sup>19</sup> Suspended AUMs are those initially adjudicated and are no longer available for use on an annual basis. These are carried forward in case they become available for use in the future from changes such as vegetation restoration, or improved water making more forage available.

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shows the number of AUMs permitted and billed annually from 1991 through 2016. Billed AUMs represent an average of 58% of permitted AUMs since designation. Billed AUMs for 2016 were associated with economic output of about \$8.3 million and supported about 184 jobs in the local economy.<sup>20</sup>



Figure 5. AUMs Permitted and Billed on Grand Staircase-Escalante National Monument

- Timber:** No commercial timber harvest is allowed within Grand Staircase-Escalante National Monument. Non-commercial firewood harvest is allowed in two forest product areas.
- Cultural/Tribal/Archeological:** Archaeological surveys carried out to date show extensive use of places within the monument by ancient Native American cultures and a contact point for Anasazi and Fremont cultures. Hundreds of recorded sites include rock art panels, occupation sites, campsites and granaries. Cultural sites include historic and prehistoric sites, Traditional Cultural Properties, Native American Sacred Sites and cultural landscapes. According to the Utah State Historic Preservation Office (SHPO), as of March 6, 2017, there are 3,985 recorded archaeological sites within GSENM. However, the GSENM staff estimates that there are more likely around 6,000 recorded archaeological sites within the GSENM, due to a records backlog. This is with only five to seven percent of the Monument surveyed. Prehistoric archaeological sites in the GSENM include pottery and stone tool (lithic) scatters, the remains of cooking features (hearths), storage features such as adobe granaries and subsurface stone lined granaries, prehistoric roads, petroglyphs, pictographs and cliff dwellings. Historic sites include historic debris scatters, roads, trails, fences, inscriptions, and structures. Following the designation of GSENM, consultations were initiated with the Native American tribes associated with the GSENM area, including the Hopi, the Kaibab Paiute, the San Juan Paiute, the Paiute Indian Tribes of Utah, the Zuni, and the Ute, and the Navajo. Over the past 20 years, the Hopi and the Kaibab Paiute have been most closely associated with the Monument and most

<sup>20</sup> BLM data.

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responsive to continued consultations, as the GSENM area is central to the historic and prehistoric territories of these two tribes.

Local ranching began in the 1860s, and became a major focus of area livelihood and increased settlement in the 1870s. Ranching was initially small scale and for local subsistence, but the herds quickly grew so that by the late 1800s the raising of cattle, sheep, and goats was of major economic importance. Ranching and subsistence farming was historically the backbone of the local economies, and this is still reflected in the views of the modern communities surrounding GSENM. In modern times the economic importance of ranching has somewhat diminished, but the culture of, and past history of, livestock grazing and ranching is one of the important “glues” that binds local communities and families in the GSENM area.

- **Scientific/Paleontological:** Approximately six percent of the area has been surveyed (120,000 acres), with 3,350 documented paleontological sites. Several new discoveries have been made including: 12 new dinosaurs (including four in 2017); 11 new mammal species; three new species of marine reptile; two new crocodile species; three new turtle species; one new lizard species; and several new shark and bony fish species. A Paleontological Traveling Exhibit Program annually provides opportunities to more than 12,000 people to see real fossils and related reconstructed specimens of dinosaurs excavated on GSENM.

### *Land Management Tradeoffs*

This section presents some information to help understand land management tradeoffs. Decision-making often involves multiple objectives and the need to make tradeoffs among those objectives. However, tradeoffs and decision-making are often subject to constraints, such as Monument designations. In general, market supply and demand conditions drive energy and minerals activity; societal preferences and household disposal income affect recreation activity levels; and market prices and range conditions affect the demand for forage. Culturally important sites and unique natural resources, by definition, have limited or no substitutes. A particularly challenging component of any tradeoff analysis is estimating the nonmarket values associated with GSENM resources, particularly the nonmarket values associated with cultural and scientific resources.

Planning for permitted resource use on National Monuments will involve trade-offs among different activities on the land area being managed in order to allow permitted activities that are compatible with monument objects. Once designated, National Monuments continue to be managed under the multiple use mandate outlined in the Federal Land Policy and Management Act of 1976. In some cases, certain areas of the Monument may be appropriate for more than one use. After the careful consideration of tradeoffs, management decisions in those cases may prioritize certain uses over others. In other cases, land areas may be more appropriate for a particular use and activities could be restricted to certain areas of the Monument. These decisions are based upon whether a use is compatible with the designation. Factors that could inform these tradeoffs include demand for the good or activity, prices, costs, and societal preferences. Other considerations might include the timeframe of the activity - how long the benefits and costs of a given activity would be expected to extend into the future. Trust responsibilities and treaty rights are also given consideration.

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In considering any trade-offs, it is not just the level and net economic value associated with an activity that occurs in a given year that is relevant to decision-making. Virtually all activities within the Monument occur over time and it is the stream of costs and benefits over a given period of time associated with each activity that is relevant. For example, recreation activities could continue indefinitely, assuming the resources required for recreation remain intact and of sufficient quality for individuals to remain interested in the activity. Likewise, the values associated with the natural and cultural resources could continue indefinitely provided they are not degraded by other activities (and assuming preferences do not change). Grazing could also continue indefinitely as long as the forage resource is sustainably managed and remains consistent with the protection of monument objects. Non-commercial timber harvest may also continue indefinitely as long as the timber resource is sustainably managed. However, the stream of costs and benefits associated with some other non-renewable resources would be finite (assuming these activities were consistent with the designation). For example, oil, gas, coal and minerals are all non-renewable resources and would only be extracted as long as the resource is economically feasible to produce.

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<b>Activities</b>	<b>Level of annual activity</b>	<b>Unit value</b>	<b>Timing</b>	<b>Drivers of current and future levels of activity</b>
Recreation	926,236 visitor days (FY 2016)	\$54.19/visitor day <sup>a</sup>	Visitation could continue indefinitely if landscape resources remain intact and of sufficient quality.	Societal preferences for outdoor recreation; disposable income; changing individual preferences for work and leisure time
Oil	45,538 bbls (2016)	FY 2016 average price crude oil (WTI): \$41.34/bbl <sup>b</sup>	Development of energy and non-energy minerals is subject to market forces (worldwide supply and demand, prices). Mineral extraction is non-renewable and occurs only as long as the resource is economically feasible to produce.	Market prices of energy commodities affect both supply and demand.
Gas	2,357 mcf (2016)	FY 2016 average price: \$2.29/mcf <sup>b</sup>		
Coal	None. See "Coal" section for more information.	May 2017 Utah average coal price: \$38.19/ton <sup>c</sup>		
Non-energy Minerals	None. See "Non-energy Minerals" section for more information.	2016 estimated price for gypsum (crude f.o.b mine): \$9.00/metric ton <sup>d</sup>		Market prices of non-energy commodities affect both supply and demand. Mineral production is limited to 200,000 cubic yards over a 10-year period per the existing resource management plan.
Grazing	41,567 AUMs billed (2016)	2016 grazing fee: \$2.11/AUM	Grazing could continue indefinitely if forage resources are managed sustainably.	Market prices for cattle and sheep and resource protection needs and range conditions (due to drought, fire, etc.) can affect AUMs permitted and billed.
Cultural/archeological resources	Indigenous communities often use natural resources to an extent and in ways that are different from the general population, and the role that natural resources play in the culture of these indigenous communities may differ from that of the general population. Culturally important sites and unique natural resources, by definition, have limited substitutes. Recognizing this is a critical consideration in land management because it may affect consideration of tradeoffs. Archaeological surveys carried out to date show extensive use of places within the monument by ancient Native American cultures and a contact point for Anasazi and Fremont cultures. To date, approximately 6% of GSENM has been surveyed.			

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Table 3. Summary of Activities and Economic Values, 2016	
Scientific/Paleontological resources	Approximately 6% of the area has been surveyed. New discoveries include: 12 new dinosaurs, 11 new mammal species, 3 new marine reptile species, 2 new crocodile species, 3 new turtle species, 1 new lizard species, and several new shark and bony fish species.
Benefits of nature	Services provided by nature underpin all sectors of a local economy. As many of these services are not sold in markets, we have limited information on their prices or values. Specific benefits related to GSENM include protection of scenic and geologic resources, cryptobiotic soils, and habitats for mountain lion, bear, desert bighorn sheep, and more than 200 species of birds, and relict plant species as well as riparian corridors.
<p><sup>a</sup> This value represents the estimated consumer surplus associated with general recreation for the Intermountain region from the USGS Benefit Transfer Toolkit (<a href="https://my.usgs.gov/benefit-transfer/">https://my.usgs.gov/benefit-transfer/</a>). Consumer surplus represents values individuals hold for goods and services over and above expenditures on those goods and services.</p> <p><sup>b</sup> Prices from EIA.gov</p> <p><sup>c</sup> Coal price from ONRR May 2017 Monthly Market Analysis Report</p> <p><sup>d</sup> Gypsum price from USGS <a href="https://minerals.usgs.gov/minerals/pubs/commodity/gypsum/mcs 2017 gypsu.pdf">https://minerals.usgs.gov/minerals/pubs/commodity/gypsum/mcs 2017 gypsu.pdf</a></p>	

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# Bears Ears National Monument

Economic Values and Economic Contributions



Bears Ears  
National  
Monument



Office of Policy Analysis, June 14, 2017

## Introduction

The purpose of this paper is to provide information on the economic values and economic contributions of the activities and resources associated with Bears Ears National Monument (BENM) as well as to provide a brief economic profile of San Juan County.<sup>1</sup>

## Background

The Bears Ears National Monument encompasses 1.35 million acres of land in San Juan County, UT and was established in 2016 for the purposes of protecting lands that contained cultural, prehistoric, historic, geologic, and scientific resources, including objects of archaeological significance. Prior to establishment of the Monument, all lands within the Monument boundaries were Federal lands managed by BLM (Monticello Field Office) and the USFS (Manti-La Sal National Forest), with the exception of about 100,000 acres of land owned by the State of Utah (managed by the Utah School and Institutional Trust Lands Administration (SITLA)) and smaller private parcels.<sup>2</sup> Of the BLM and Forest Service acreage, 57% was managed with some level of protective designation under the existing land use plans as Natural Areas, Areas of Critical Environmental Concern, and Special Recreation Management Areas; or as designated Wilderness Study Areas. There have been several previous proposals to protect land in the Bears Ears area.<sup>3</sup>

A management plan for the Monument has not yet been drafted. Development of a management plan is anticipated to require 5 years and involve extensive public involvement.<sup>4</sup> The Presidential proclamation established the Bears Ears Commission, consisting of one elected official each from five different tribes (Hopi Tribe, Navajo Nation, Ute Mountain Ute Tribe, Ute Indian Tribe of the Uintah Ouray, and Zuni

### Bears Ears National Monument

Location: San Juan County, UT

Managing agencies: BLM, USFS

Adjacent cities/counties/reservations:

- Counties: San Juan County, UT
- Reservations: Navajo Nation
- Cities: Bluff, UT; Blanding, UT; Monticello, UT; Navajo Nation Reservation

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<sup>1</sup> The BLM and Forest Service provided data used in this paper.

<sup>2</sup> SITLA serves as fiduciary of Utah's 3.4 million acres of trust lands, parcels of land held in trust to support 12 state institutions, primarily the K-12 public education system. SITLA is constitutionally mandated to generate revenue from trust lands to build and grow permanent endowments for these institutions. Utah's public school system is the largest beneficiary, holding 96% of all Utah trust lands. Economic activities occurring on SITLA land in the area are similar to those on adjacent Federal land, including visitation to prominent cultural resource sites and livestock grazing. Different rules apply to grazing on SITLA land versus Federal land, such as allowing SITLA to post expiring permits on the agency's website, establish 15 years as the maximum length for grazing permits, and set a fee of \$10/Animal Unit Month (AUM) when permits are assigned. The 2016 BLM grazing fee was \$2.11/AUM. The Forest Service grazing fee was \$2.11/Head Month (HM). AUMs and HMs are treated as equivalent measures for fee purposes.

<sup>3</sup> Proposals to protect land in the Bears Ears area date back over 80 years. In 2015, the "Inter-Tribal Coalition for Bears Ears" proposed establishing a 1.9 million acre national monument.<sup>3</sup> Utah Congressmen Rob Bishop and Jason Chaffetz proposed establishing two National Conservation Areas (NCAs) -- Bears Ears and Indian Creek -- totaling 1.3 million acres as part of their Public Lands Initiative (PLI). National Conservation Areas are designated by Congress. In contrast to the Inter-Tribal Coalition's proposal, the PLI did not specify that all areas were to be withdrawn from future mineral development, placed a restriction on decreasing grazing permits in one of the proposed NCAs, and placed restrictions on Federal negotiations with the State of Utah for land exchanges for State-owned land within the proposed boundaries.

<sup>4</sup> Land management plans are developed in compliance with the Federal Land Policy and Management Act (FLPMA) and NEPA regulations, the National Forest Management Act (NFMA), and the Forest Service 2012 Planning Rule.

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Tribe). The Commission is to work with the Federal government to provide guidance and recommendations on the development and implementation of management plans and on management of the monument. The Proclamation also requires a Monument Advisory Committee (MAC) be established according to the Federal Advisory Committee Act (FACA) regulations. In addition, DOI sought to enter into a MOU with the State of Utah to negotiate the exchange of state land within the Monument boundaries for other BLM land outside the Monument.<sup>5</sup>

#### Public outreach prior to designation

A public meeting was held in Bluff, UT in July 2016. Over 1,500 individuals attended, including representatives from DOI, USDA, tribes, members of the Utah congressional delegation, and Utah state legislature. In addition, almost 600 written comments were submitted, the majority of which were in favor of the Monument designation.<sup>6</sup>

#### Local Economy and Economic Impacts

Table 1 presents socio-economic metrics for San Juan County and the state of Utah. The County contains roughly 0.5% of the State's population. The population of the county increased about 5% from 2000 to 2015. Nearly half of the population of the county is Native American. The median household income of Native Americans in San Juan County is over 40% lower than that of the total county population (see Table 1). The county has historically experienced higher levels of unemployment and lower levels of median household income in comparison to the State.

The San Juan County economy is dependent upon recreation-based or tourism-based businesses.<sup>7</sup> The accommodation and food services industry is the largest sector by employment (see Figure 1), accounting for about 30% of total employment in the county.<sup>8</sup>

Table 1. San Juan County and State of Utah Economic Snapshot

Measure	San Juan County, UT	Utah
Population, 2016 <sup>a</sup>	15,152	2,903,379
Native American % of population <sup>a</sup>	47.0%	1.1%
Employment, December 2016 <sup>c</sup>	2,299	1,187,682
Unemployment rate, March 2017 <sup>b</sup>	7.0%	3.1%
Median Household Income, 2015 <sup>a</sup>	\$41,484	\$60,727
Native American Median Household Income, 2015 <sup>a</sup>	\$24,132	\$36,428

<sup>a</sup> U.S. Census Bureau, 2011-2015 American Community Survey

<sup>b</sup> <http://www.jobs.utah.gov/wi/pubs/une/season.html>.

<sup>c</sup> [https://data.bls.gov/ccw/apps/data\\_views/data\\_views.htm#tab\\_Tables](https://data.bls.gov/ccw/apps/data_views/data_views.htm#tab_Tables)

<sup>5</sup> A May 2017 SITLA land auction included a 1,120 acre parcel within BENM, the Needles Outpost, which sold for \$2.5 million, or \$2,232 per acre (<https://trustlands.utah.gov/land-auction-earns-3-million-for-public-schools/>).

<sup>6</sup> Fast Facts and Q&A about the Bears Ears National Monument Designation, BLM.

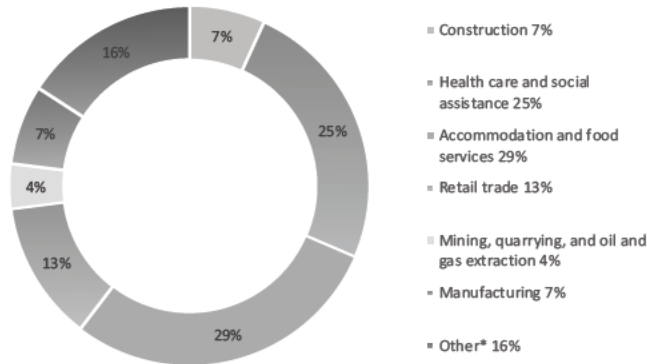
<sup>7</sup> Approved Resource Management Plan for Monticello Field Office, 2008

<sup>8</sup> U.S. Census Bureau County Business Patterns, 2015

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Figure 1. Percent of employment by sector in San Juan County, 2015



\*Other includes agriculture/forestry; utilities; wholesale trade; finance and insurance; real estate; professional, scientific and technical services; admin and support services; waste management; educational services; arts and entertainment; and transportation and warehousing. Each of these represents less than 4% of total employment. Source: 2015 County Business Patterns, U.S. Census Bureau.

The figures provided below represent two different types of economic information: “economic contributions,” and “economic values.” Both types of information are useful for decision-making. Economic contributions track expenditures as they cycle through the local and regional economy, supporting employment and economic output. *Table 2* provides estimates of the economic contribution of activities associated with BENM. It is estimated that recreation activities in the BENM area supported about 460 jobs and provided about \$23 million in value added in FY 2016.

#### Definitions

**Value Added:** A measure of economic contributions; calculated as the difference between total output (sales) and the cost of any intermediate inputs.

**Economic Value:** The estimated net value, above any expenditures, that individuals place on goods and services; these are particularly relevant in situations where market prices may not be fully reflective of the values individuals place on some goods and services.

**Employment:** The total number of jobs supported by activities.

Economic values, in contrast to economic contributions, represent the net value, above and beyond any expenditures, that individuals place on goods and services.<sup>9</sup> To the extent information is available, economic values are presented in *Table 3* along with information on the timing and drivers of future activity. For commodities bought and sold in markets (e.g., oil, gas, etc.), the economic values are closely related to the market prices of the commodities. For goods and services such as recreation that are typically not bought and sold in markets, the values are estimated based on visitor surveys which attempt

<sup>9</sup> It is not appropriate to sum values for economic contributions and economic values because they represent different metrics.

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to capture individual values above and beyond their direct expenditures. The economic value in FY 2016 associated with recreation is estimated to be about \$30 million

### *Activities and Resources Associated With Bears Ears National Monument*

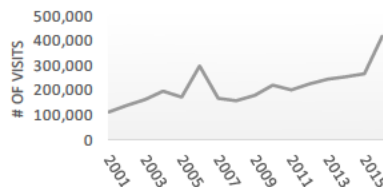
Information on the economic contributions associated with the activities occurring at Bears Ears National Monument are provided below.

- **Recreation:** Annual recreation visitation data for FY 2001-

2016 is available for the BLM Monticello Field Office. About 60 percent of the area formerly under the jurisdiction of the Field Office represents the area included in the BENM. This area receives the vast majority of recreation use on BLM managed lands within the Field Office boundary. Recreation visits increased steadily from an estimated 111,000 in FY 2001 to about 419,000 in 2016 (see Figure 2). In comparison, visitation to National Monuments and NCAs that have tracked unit-level visitation since 2005 has grown at an average rate of about 5.4% per year. Prior to designation, BLM also tracked the number of visits to the Kane Gulch ranger station that served the southern end of the Monument. The number of visits to this ranger station in March and April of 2017 was more than 50% higher than the average visitation during the same months of the four previous years.

Annual recreation visits to the Manti-La Sal National Forest, part of which is now within BENM boundaries, are estimated to number around 350,000. USFS estimates that around 35,000 visits are to the area that is now contained within Mounument boundaries. An increase in visitation to this area of the Manti-La Sal National Forest has been locally observed since designation.<sup>10</sup>

Figure 2. Recreation Visits to BLM Monticello Field Office, 2001-2016



Recreation activities provide the opportunity for economic activity to be generated from tourism for an indefinite period of time. The economic contributions occur annually, and in cases where visitation increases over time, recreation generates additional activity each year. These contributions affect the regional and state economies. Recreation activities based on visitation to BLM-managed land are estimated to contribute about \$23 million in value added (net economic

<sup>10</sup> USFS data.

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contributions) and support 463 jobs<sup>11</sup>; these could be considered conservative estimates for the Monument area as a whole, as they do not include the impacts of visitation to USFS-managed land. Including the estimated 35,000 annual visits to the USFS-managed land, recreation activities based on visitation to all land within Monument boundaries are estimated to contribute about \$27 million in value added and support 473 jobs<sup>12</sup>; the values should be considered an upper bound as there may be some double-counting between visits to BLM-managed and to USFS-managed land.

- **Energy:** In general, the scope, magnitude, and timing of energy and minerals activities are closely related to supply and demand conditions in world markets and the market prices of mineral commodities. Local or regional cost considerations related to infrastructure, transportation, etc. also may play a role in defining the supply conditions. To date, energy development on the Monument has been limited.
  - **Coal.** There have been no coal developments in the Monument area. Furthermore, there is very little, if any, prospectively valuable coal within the Monument boundaries, based on the energy and mineral resource assessment conducted for BENM. Potential for prospectively valuable coal, as surveyed by the USGS, lies almost entirely to the east of the Monument.<sup>13</sup>
  - **Oil and gas.**
    - There are currently no producing oil and gas wells within the Monument. USGS assessments indicate a high level of potential for oil and gas for an assessment unit that includes the monument boundaries, though it is not scientifically valid to statistically assign energy resource numbers in an assessment unit to a specific area.<sup>14</sup> The upper northeast panhandle of BENM lies within the boundaries of the Moab Master Leasing Plan (approved in December 2016) and portions of the southeastern and southcentral areas of the Monument were included in a proposed San Juan Master Leasing Plan.<sup>15</sup> Approximately 63,600 acres within the proposed San Juan Master Leasing Plan planning area have been nominated for leasing since 2014. All of these lease nominations were deferred due to existing land use plan decisions and potential adverse impacts on cultural resources.
    - There are currently 23 existing federal oil and gas leases that are partially or wholly contained within the Monument boundaries on BLM-managed lands, with lease authorizations spanning the period from 1972 to 2012. Valid existing rights

<sup>11</sup> BLM data.

<sup>12</sup> USFS data.

<sup>13</sup> BLM data.

<sup>14</sup> The Monument area is within a USGS Energy Assessment Unit (AU) and has historic uranium mining activity (the Monument is within 2 conv. AUs and 1 cont. AU, Paradox Basin Province (315 MMBO, 999 BCF, 18 MMBNGL) <https://pubs.usgs.gov/fs/2012/3031/>.

<sup>15</sup> Master Leasing Plans (MLPs) establish a framework for determining which areas are appropriate for responsible exploration and development of minerals while protecting the area's conservation resources. MLPs also provide direction for resolving resource conflicts, protecting important conservation resources, and supporting outdoor recreation and other activities that benefit local communities and public land visitors. For additional information on the Moab MLP see [https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName\\_dispatchToPatternPage&currentPageId\\_99717](https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName_dispatchToPatternPage&currentPageId_99717).

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are protected under the proclamation, so development on these existing leases could occur if development is found to be economic. Currently, there are no authorized or pending applications for permit to drill (APDs) associated with these leases. No oil and gas wells have been drilled on existing leases since 1993 and all wells within Monument boundaries have been plugged. Of the 250 wells that have been drilled since 1920, only three wells have produced economical quantities of oil and gas. The last producing well was drilled in 1984 and ceased production in 1992.

- **Non-fuel minerals.**

- **Sand and gravel.** There is one commercial minerals materials mining site within Monument boundaries on BLM-managed land that produces sand and gravel. The permit for this site was renewed in March, 2016 for a 10-year period. Production is limited to a maximum of 200,000 cubic yards over the life of the 10-year permit, and designation of the Monument does not affect the limits on production.<sup>16</sup>
- **Potash.** While USGS surveys have assessed potential for potash in the northeastern panhandle of BENM (an area within the boundaries of the Moab Master Leasing Plan prior to designation), no sites in this area were identified as Potash Leasing Areas in the most recent Moab Master Leasing Plan (2016). BLM has denied all potash prospecting permit applications received from 2008 to 2015, primarily because they were inconsistent with protection of multiple resource values use (such as natural or cultural use) in the area.<sup>17</sup>
- **Uranium and other locatable minerals.** While there are no active mining operations on USFS-managed land, there are 78 active unpatented mining claims for uranium. The uranium ore in the Manti-La Sal National Forest is low grade, affecting the ability of the local industry to compete economically on the world market.<sup>18</sup> There are 266 mining claims on BLM-administered lands inside BENM. There are no active operations associated with these claims. Based on historic mining activity in the region, many of these claims may be associated with uranium. However, BLM does not require claimants to identify the mineral claimed. Uranium prices are volatile and, though currently higher than historical prices, have been trending downward since peaking in 2008.<sup>19</sup>

- **Timber.** The Proclamation does not affect existing laws, regulations, and policies followed by USFS or BLM associated with timber activities. Timber harvest activities such as non-

<sup>16</sup> Supply and demand conditions determine how much is produced annually within the overall limit on production. BLM receives a royalty of \$1.08 per cubic yard (\$0.66 per ton) of mineral production. The national average price for sand and gravel used in construction in 2016 was \$8.80/metric ton ([https://minerals.usgs.gov/minerals/pubs/commodity/sand\\_&\\_gravel/construction/mcs-2017-sandc.pdf](https://minerals.usgs.gov/minerals/pubs/commodity/sand_&_gravel/construction/mcs-2017-sandc.pdf)).

<sup>17</sup> Potash production depends largely on market forces. U.S. consumption of potash was down in 2016 owing to a drop in agricultural use in the first half of the year and lower industrial usage, primarily in oil well-drilling mud additives. The world potash market in 2016 was marked by weak demand in the first half of the year, mainly in China and India, the largest consumers of potash. This excess supply resulted in lower prices, and reduced production. The average price of potash in 2016 was \$360 per ton.

<sup>18</sup> Manti-La Sal National Forest Land and Resource Management Plan, 1986.

<sup>19</sup> <https://www.eia.gov/uranium/marketing/>.

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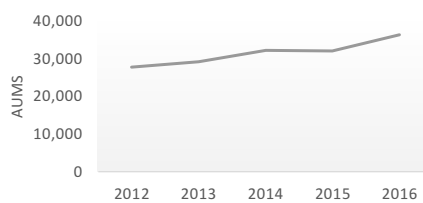


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commercial Christmas tree cutting and collection of wood for posts and firewood are allowed by permit on both BLM and USFS-managed land. For BLM-managed lands, no information is available on the level of magnitude of these activities strictly within Monument boundaries, however within the boundaries of the Monticello Field Office the total estimated value of permit sales for harvesting firewood, wooded posts, and Christmas trees was about \$12,000 in FY 2016.<sup>20</sup> There have not been any recent commercial timber activities on USFS-managed land. The Monument proclamation allows for the continuation of all pre-designation timber activities.

- Forage.** The Monument proclamation allows for the continuation of all pre-designation grazing activities, including maintenance of stock watering facilities. The allotments that are wholly or partially contained within the boundaries of BENM include 50,469 permitted Animal Unit Month (AUMs)<sup>21</sup> on BLM-managed land and 11,078 AUMs permitted on USFS-managed land. Figure 3 shows the number of AUMs billed by BLM annually over 2012-2016. In 2016, there were about 36,400 billed AUMs on BLM-managed land and about 9,700 billed AUMs<sup>22</sup> on USFS-managed land.

Figure 3. BLM AUMs Billed, 2012-2016



- Cultural, archeological, and historic resources.** Indigenous communities may utilize natural resources to an extent and in ways that are different from the general population, and the role that natural resources play in the culture of these indigenous communities may differ from that of the general population. Culturally important sites and unique natural resources, by definition, have limited or no substitutes. Recognizing this is a critical consideration in land management because it may affect consideration of tradeoffs. Activities currently undertaken by tribal members include hunting, fishing, gathering, wood cutting, and the collection of medicinal and ceremonial plants, edible herbs, and materials for crafting items like baskets and footwear.

According to the Utah State Historic Preservation Office, as of Feb. 6, 2017, there are 8,480 recorded archaeological sites and four archaeological districts within BENM. The following archaeological districts are either completely within or partially within BENM: Butler Wash, Grand Gulch, Natural Bridges, and the Salt Creek Archaeological District. More than 70 percent of the sites are prehistoric (pre-dating the 1800s). These prehistoric sites include pottery and stone tool (lithic) scatters, the remains of cooking features (hearths), storage features such as adobe granaries and subsurface stone lined granaries, prehistoric roads, petroglyphs, pictographs and cliff dwellings. The remaining sites are historic and include debris scatters, roads, fences,

<sup>20</sup> This does not necessarily represent a market value.

<sup>21</sup> BLM measures an AUM as the amount of forage needed to sustain one cow and her calf, one domestic horse, or 5 sheep or goats for one month. <https://www.blm.gov/programs/natural-resources/rangelands-and-grazing/livestock-grazing/fees-and-distribution>.

<sup>22</sup> USFS billed 7,335 Head Months in 2016, which were converted to AUMs using a conversion factor of 1.32.

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and uranium and vanadium mines from World War II and the Cold War. About 9% of the BLM-managed portion of BENM has been surveyed for cultural resources.

The USFS-managed portion of BENM includes 2,725 known cultural sites and features an area containing over 2,027 Puebloan sites, most of which are *Pueblo I*. The *Pueblo I* culture is limited to only a few locations and the USFS-managed portion of BENM contains the only high elevation communities of this era. These sites include hunting camps and blinds, ceremonial sites, granaries, stone quarries, villages and residences, agricultural systems, kilns, rock art, and shrines, as well as protohistoric sweat lodges and hogans. Only 15-20% of the USFS-managed portion of BENM has been surveyed for cultural resources.

### *Multiple Use and Tradeoffs Among Resource Uses*

Decision-making often involves multiple objectives and the need to make tradeoffs among those objectives. However, tradeoffs and decision-making are often subject to constraints, such as Monument designations. In general, market supply and demand conditions drive energy and minerals activity; societal preferences and household disposal income affect recreation activity levels; and market prices and range conditions affect the demand for forage. Culturally important sites and unique natural resources, by definition, have limited or no substitutes and thus tradeoffs are typically limited. A particularly challenging component of any tradeoff analysis is estimating the nonmarket values associated with BENM resources, particularly the nonmarket values associated with cultural resources.

Planning for permitted resource use on National Monuments will involve trade-offs among different activities on the land area being managed in order to allow permitted activities that do not impair monument objects. In some cases, certain areas of the Monument may be appropriate for more than one use. After the careful consideration of tradeoffs, management decisions in those cases may prioritize certain uses over others. In other cases, land areas may be more appropriate for a particular use, and activities could be restricted to certain areas of the Monument. Factors that could inform these tradeoffs include demand for the good or activity, prices, costs, and societal preferences. Other considerations might include the timeframe of the activity how long the benefits and costs of a given activity would be expected to extend into the future. Trust responsibilities and treaty rights are also given consideration.

In considering any trade-offs, it is not just the level and net economic value associated with an activity that occurs in a given year that is relevant to decision making. Virtually all activities within the Monument occur over time and it is the stream of costs and benefits over a given period of time associated with each activity that is relevant. For example, recreation activities could continue indefinitely assuming the resources required for recreation remain intact and of sufficient quality for the activity. Likewise, the values associated with the natural and cultural resources could continue indefinitely provided they are not degraded by other activities. Grazing could also continue indefinitely as long as the forage resource is sustainably managed and remains consistent with the protection of monument objects. Timber harvest may also continue indefinitely as long as the timber resource is sustainably managed. The stream of costs and benefits associated with some other non-renewable resources would be finite, however (assuming these activities were consistent with the designation). For example, oil, gas, coal and minerals are all non-renewable resources and would only be extracted as long as the resource is economically feasible to produce.

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In the 2008 update to the Resource Management Plan for the Monticello Field Office, 60% of which is now BENM, an alternative emphasizing commodity development was considered but not selected due to its adverse impacts on wildlife and recreation opportunities, which includes visits for cultural purposes. This alternative was determined to be insufficient to protect all the important and sensitive resources within the planning area. Likewise, an alternative emphasizing protection of the area's natural and biological values was not selected in part due to the restrictions it placed on recreation permits and opportunities, which would have resulted in negative economic impacts on local businesses.

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Table 3. Summary of BENM Activities and Economic Values, FY 2016

Activities	Level of annual activity	Economic Value	Timing	Drivers of current and future levels of activity
Recreation	FY 2016: 530,892 visitor days (BLM) 35,000 visitors (USFS)	\$54.19/visitor day <sup>a</sup>	Visitation could continue indefinitely if landscape resources remain intact and of sufficient quality.	Societal preferences for outdoor recreation; disposable income; changing individual preferences for work and leisure time
Oil, gas, coal production	Little or none to date, see "Oil and gas" section for more information	FY 2016 average prices <sup>b</sup> : crude oil (WTI): \$41.34/bbl natural gas: \$2.29/mcf coal (subbituminous): \$12.08/ton	Development of energy and non energy minerals is subject to market forces (worldwide supply and demand, prices). Mineral extraction is non renewable and occurs only as long as the resource is economically feasible to produce.	Market prices of energy commodities affect both supply and demand. Local and regional cost considerations related to infrastructure and transportation are also relevant.
Non energy Minerals	34,813 tons <sup>c</sup> of sand and gravel (average of 2011-2015 production)	National average price for sand and gravel (2016): \$8.80/ton <sup>d</sup>		Market prices of non energy commodities affect both supply and demand. Mineral production is limited to 200,000 cubic yards over a 10 year period per the existing resource management plan.
Grazing	2016 billed AUMs: 36,402 AUMs (BLM) 9,682 AUMs (USFS)	2016 grazing fee: \$2.11/AUM	Grazing could continue indefinitely if forage resources are managed sustainably.	Market prices for cattle and sheep and resource protection needs and range conditions (due to drought, fire, etc.) can affect AUMs permitted and billed.
Cultural resources	Indigenous communities often use natural resources to an extent and in ways that are different from the general population, and the role that natural resources play in the culture of these indigenous communities may differ from that of the general population. Culturally important sites and unique natural resources, by definition, have limited or no substitutes. Recognizing this is a critical consideration in land management because it may affect consideration of tradeoffs. BENM contains substantial cultural resources that have not been fully surveyed. Tribes use the sacred sites within BENM for hunting; fishing; gathering; wood cutting; and for collection of medicinal and ceremonial plants, edible herbs, and materials for crafting items like baskets and footwear.			
Benefits of nature	Services provided by nature underpin all sectors of a local economy. As many of these services are not sold in markets, we have limited information on their prices or values. Specific benefits related to BENM include protection of crucial habitats for deer, elk, desert bighorn sheep, pronghorn, and endemic plant species that inhabit rare habitat types such as hanging gardens.			

<sup>a</sup> This value represents the estimated consumer surplus associated with general recreation for the Intermountain region from the USGS Benefit Transfer Toolkit(<https://my.usgs.gov/benefit-transfer/>). Consume surplus represents values individuals hold for goods and services over and above expenditures on those goods and services.<sup>b</sup> All prices are from EIA.gov<sup>c</sup> Reported average production of 21,396 cubic yards converted to tons using a conversion factor of 1.63 cu yards/ton.<sup>d</sup> USGS Mineral Commodity Survey [https://minerals.usgs.gov/minerals/pubs/commodity/sand\\_&\\_gravel/construction/mcs-2017-sandc.pdf](https://minerals.usgs.gov/minerals/pubs/commodity/sand_&_gravel/construction/mcs-2017-sandc.pdf)